UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 155
Seattle, WA 98101-3188

SUPERFUND &
EMERGENCY
MANAGEMENT DIVISION

May 22, 2020

MEMORANDUM

SUBJECT: EPA Comments on the Smoky Canyon Mine Water Treatment Plant Study Iron Coprecipication Full-Scale Pilot Technical Memorandum (Simplot, 5/11/2020)

FROM: Jennifer Crawford, Remedial Project Manager, U.S. EPA Region 10 Jennifer Crawford Digitally signed by JENNIFER CRAWFORD Date: 2020.05.22 08:36:22 -07'00'

TO: Arthur Burbank, Remedial Project Manager, U.S. Forest Service

This memorandum captures EPA's comments on the Simplot TM letter received 5/11/2020 regarding proposed changes to the Smoky Canyon Hoopes Spring treatability pilot water treatment plant. Comments below were provided by request to EPA Region 10 from the ORD ETSC staff: Barbara Butler, Ph.D., Environmental Engineer; Robert Ford, Ph.D., Environmental Scientist.

Please let me know if you have any questions, clarification needed or want to discuss further.

System Background:

Problem: Some particulate selenium generated in the FBR is being captured in the aerobic biomass of the activated sludge system and is slowly oxidizing.

Proposed solution: Add ferric chloride to co-precipitate the selenium. They state jar tests and field trial results have indicated the percentage of selenium removal can be increased by iron coprecipitation.

Relevant system information:

- The aerobic activated sludge system is a post-treatment system to oxidize sulfides and COD present in the FBR effluent and to add oxygen
- Nutrients added to the post-treatment system include ammonium sulfate and phosphoric acid
- The file "Ph2WPSAPfinalMar2017.pdf" states that the 2nd stage FBR operates in downflow mode and serves to filter selenium and biomass
- The addendum to the workplan (file "Addm01Ph2_20170810.pdf") discusses dewatering of FBR solids
- Recognized potential issues in the memo
    - System will generate additional solids that will require reducing the solids retention time and more frequent dewatering
    - Reduction in retention time will impact ability to completely nitrify excess ammonia to nitrate
        - The proposed mitigation is to decrease ammonium sulfate dosed to the basins if the effluent nitrogen targets are not met

Specific Comments/Questions:

- Is the selenium present as selenite or selenate, or some combination of both? Stepwise oxidation is Se (0) to Se (IV) to Se (VI). What is the pH of the activated sludge basins?
    - Ferric iron co-precipitation/adsorption is common and effective treatment for selenite but is minimally effective for selenate. Selenate needs to be reduced to selenite before being able to be removed by ferric iron coprecipitation.
    - Removal efficiency by coprecipitation is dependent on pH and increases with lower pH (below ~ 7).
- Precipitation of ferric oxyhydroxides releases protons.
    - How will the pH of the activated sludge be controlled? Will the effluent from the tanks require pH modification prior to discharge?
- What would be the final overall percentage of selenium removal? Would the system meet limits with this additional step?
- Ferric chloride is a commonly used reagent for removal of phosphorus from wastewater, through formation of ferric phosphate and sorption onto ferric oxyhydroxides. Phosphorus has a greater affinity for ferric oxyhydroxides than does selenite (e.g., Balistrieri and Chao, 1990).
    - Were jar tests conducted with water from the activated sludge system that also contained the phosphoric acid?
    - Has there been consideration of how the new composition of the returned sludge (Figure 3-8 of the workplan) will influence required phosphoric acid dosing?
- Typically, clarification and filtration are used for iron oxyhydroxide sludge. The memo notes that the solids generated will be of higher density and that the "clarifier operations will be monitored to evaluate the ability of the clarifier to handling [sic] the higher sludge density."
    - What is being planned if the clarifier is unable to handle the higher density sludge?
        - Suggest that a plan be in place prior to commending the ferric chloride addition.
- It isn't clear how the biosolids are removed from the FBR to be dewatered. It appears that some of the biomass enters the post-treatment activated sludge tanks/basins, but it is not clear how much.
    - Has inclusion of a nano-filtration step prior to the FBR effluent going to the post-treatment tanks been considered? Has a long-term cost analysis been done to compare that potential mitigation measure with the currently proposed one?

Balistrieri, Laurie S. and T.T. Chao. 1990. Adsorption of selenium by amorphous iron oxyhydroxide and manganese dioxide. Geochimica et Cosmochimica Acta. 54:739-751.